

REMARKS

Claims 13-20, 27-33, 35-40, 55, and 58-66 will pending upon entry of the present amendment. Claim 55 is being amended to include the language of claim 57. Claims 56-57 are being canceled. Claims 1-12, 21-26, 34, and 41-54 were previously canceled. No new matter is being submitted.

Claims 13-16, 18, 27-29, 55-58, 60, 62, and 65 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,465,271 to Ko et al. ("Ko").

Ko does not disclose the invention recited in claim 13. Claim 13 recites a device that includes "a first body and a second body welded together through a mechanical and electrical connection structure." Ko does not disclose such first and second bodies welded together through a mechanical and electrical connection structure. Instead, Ko repeatedly states that a diaphragm 152 of a wafer B is silicon fusion bonded to a wafer A (see Abstract, lines 9-14; Summary of the Invention, col. 5, lines 62-63). As known in the art, such silicon fusion bonding is not welding. As described in the attached pages 70-72 from "Silicon Processing for the VLSI Era," volume 2, by Stanley Wolf, silicon fusion bonding involves a chemical reaction of oxygen from a silicon dioxide with the silicon from two wafers. That is not welding, which instead involves uniting two materials by melting.

Ko also does not disclose "an electrically conductive region welded between said first body and said second body," as recited in claim 13. Ko does not disclose such an electrically conductive region welded between first and second bodies, for at least two reasons. First, Ko states that the diaphragm 152 of wafer B is silicon fusion bonded to the surface of wafer A via an intermediary oxide layer 104a" (see col. 9, lines 50-52 and Figs. 1E-1L). As is well known, such an oxide layer 104a" is not an electrically conductive region and is not welded.

Second, Ko also discloses a bottom electrode 112a on the wafer A, but explicitly requires that the electrode 112a not be made of any common metal because the silicon fusion bonding temperature is too high (col. 11, lines 17-27). Ko instead forms the electrode 112a of a "boron heavily diffused layer" of the substrate 102 of wafer A. Such an electrode 112a is not welded and is part of the substrate 102 of wafer A rather than being between the wafers A and B.

For the foregoing reasons, claim 13 is not anticipated by Ko.

Claims 14-16 and 18 depend on claim 13, and thus, are also not anticipated by Ko. In addition, Ko does not disclose the features recited in claims 14-15. In particular, claim 14 recites that the electrically conductive region is of a low-melting eutectic material. The oxide layer 104a" and the electrode 112a are certainly not of a low-melting eutectic material. In addition, claim 15 further recites that the low-melting eutectic material is formed by alternating layers of gold and tin. Ko never mentions gold, tin, or any alternating layers of materials. The Examiner notes that gold and tin are well-known eutectic materials, but that is not disclosed by Ko, and thus, is not a proper basis for an anticipation rejection. Accordingly, claims 14-15 are not anticipated by Ko.

Ko also does not disclose the invention recited in claim 27. Claim 27 recites a device that includes a first metal region formed on a first surface of a first body, a second metal region formed on a first surface of a second body, and a connection structure bonded to the first and second metal regions and forming an electrical connection between the first and second metal regions. As discussed above, the oxide layer 104a" and the electrode 112a are not metal regions. Even if one ignored the explicit teaching of Ko against using a metal for the electrode 112a, one would still not satisfy the claim language because there would still be no metal region on the wafer B/diaphragm 152 and there would still be no electrical connection structure bonded to the electrode 112a or to the non-existent metal region of the wafer B/diaphragm 152. Indeed, there can be no electrical connection structure bonded from a metal region of the wafer B/diaphragm 152 to the electrode 112a, because the oxide layer 104a" completely covers the electrode 112a (see Figure 1F). Accordingly, claim 27 is not anticipated by Ko.

Claims 28-29 depend on claim 27, and thus, are also not anticipated by Ko. In addition, Ko does not disclose the features recited in claims 28-29. Claim 28 recites that the connection structure is a low-melting eutectic material welded to the first and second metal regions. As discussed above, there is no electrical connection structure connected to either the oxide layer 104a" or the electrode 112a, so Ko cannot possibly disclose that such a non-existent structure is a low-melting eutectic material. Claim 29 recites that the first and second metal regions and the connection structure are formed within the first cavity defined by the spacer. As discussed above, there are no such metal regions on the wafers A, B and no electrical connection

structure between such metal regions, so Ko cannot possibly disclose that such non-existent structures are formed in a first cavity. Accordingly, claims 28-29 are not anticipated by Ko.

Ko also does not disclose the invention recited in independent claim 55, as amended to include the language of claim 57, which is being canceled. Amended claim 55 recites a device with “an electrically conductive region welded between the first and second bodies and positioned adjacent to the spacer.” As discussed above with respect to claim 13, Ko does not disclose such an electrically conductive region welded between first and second bodies. Accordingly, claim 55 is not anticipated by Ko.

Claims 58, 60, 62, and 65 depend on claim 55, and thus, are also not anticipated by Ko.

Claims 15, 17, 30, 59, 61-62, and 65 were rejected under 35 U.S.C. § 103 as being unpatentable over Ko in view of U.S. Patent No. 5,633,535 to Chao et al. (“Chao”)¹.

Ko and Chao do not teach or suggest the invention recited in claims 15 and 17, which depend on claim 13. As discussed above, Ko does not teach “a first body and a second body welded together through a mechanical and electrical connection structure” or “an electrically conductive region welded between said first body and said second body,” as recited in claim 13. In fact, Ko explicitly teaches away from such welded structures by stating that the “conductive areas cannot use common metals ... since the SFB annealing temperature is normally higher than the eutectic temperature of most metals with the silicon substrate material” (col. 11, lines 22-27). As such, one skilled in the art would have been explicitly motivated away from combining Ko with any reference that employed such welded structures. Accordingly, claims 15 and 17 are nonobvious in view of Ko and Chao.²

Ko and Chao also do not teach or suggest the features recited in claim 15. Claim 15 recites that the electrically conductive region is a low-melting eutectic material formed by

¹ The Examiner noted on page 4 that claims “17-61, 30, 62” were being rejected, but pages 4-6 discuss claims 15, 17, 30, 59, 61-62, and 65 and claims 21-26, 34, and 41-54 were already canceled, so the applicant believes that the Examiner intended to reject claims 15, 17, 30, 59, 61-62, and 65 and not “17-61, 30, 62.” If that belief is not correct, then the Examiner is requested to clarify the rejection.

² If the Examiner also intended to reject claims 18-20 and 35-40 based on Ko and Chao, such a rejection would be incorrect for at least the reasons discussed for claims 15 and 17, given that claims 18-20 and 35-40 also depend on claim 13.

alternating layers of gold and tin. Neither Ko nor Chao mentions gold, tin, or alternating eutectic layers. The Examiner notes that gold and tin are well known eutectic materials, but that does not satisfy the claim language which requires alternating layers of gold and tin. The Examiner has not pointed to any teaching or suggesting of such alternating layers of any eutectic materials. Accordingly, claim 15 is further nonobvious in view of Ko and Chao.

Ko and Chao do not teach or suggest the invention of claim 30, which depends on claim 27. As discussed above with respect to claims 15 and 17, Ko explicitly teaches away from any welded structures, including the welded structures recited in claim 27. As such, one skilled in the art would have been explicitly motivated away from combining Ko with any reference that employed such welded structures. Accordingly, claims 15 and 17 are nonobvious in view of Ko and Chao.³

Although the language of claims 59, 61-62, and 65 differs from that of claims 15 and 17, the allowability of claims 59, 61-62, and 65 will be apparent in view of the above discussion.⁴

Claims 19-20, 31, 59, 63-64, and 66 were rejected under 35 U.S.C. § 103 over Ko and Chao in view of Yew et al. (U.S. 6,137,164, hereafter “Yew”).

The combination of Ko, Chao, and Yew does not teach or suggest the invention recited in claims 19-20, 31, 59, 63-64, and 66. Claims 19-20, 31, 59, 63-64, and 66 each depend on one of independent claims 13, 27, and 55 discussed above. As discussed above with respect to claims 15 and 17, Ko explicitly teaches away from any welded structures, including the welded structures recited in claims 13, 27, and 55. As such, one skilled in the art would have been explicitly motivated away from combining Ko with any reference that employed such welded structures. Accordingly, claims 19-20, 31, 59, 63-64, and 66 are not rendered obvious by the cited prior art.

³ If the Examiner also intended to reject claims 27-33 based on Ko and Chao, such a rejection would be incorrect for at least the reasons discussed for claim 30, given that claims 28-33 depend on claim 27.

⁴ If the Examiner also intended to reject claims 55 and 58 based on Ko and Chao, such a rejection would be incorrect for at least the reasons discussed for claims 55, 59, 61-62, and 65, given that claim 58 depends on claim 55.

Claims 32-33 and 35-40 were rejected under 35 U.S.C. § 103 over Ko, Chao, and Yew in view of Duboz et al. (U.S. 5,726,500, hereafter “Duboz”).

The combination of Ko, Chao, Yew, and Duboz does not teach or suggest the invention recited in claims 32-40. Claims 32-40 depend on claim 27, and thus, include the limitations of claim 27 discussed above. As discussed above with respect to claims 15 and 17, Ko explicitly teaches away from any welded structures, including the welded structures recited in claims 13, 27, and 55. As such, one skilled in the art would have been explicitly motivated away from combining Ko with any reference that employed such welded structures. Given that Duboz is being cited only for teaching of optical components⁵, there seems to be no need to discuss Duboz in more detail with respect to the welded components. Accordingly, claims 32-33 and 35-40 are not rendered obvious by the cited prior art.

The applicant believes that the present amendment resolves all issues remaining in this case. If the Examiner discovers any further issues, the Examiner is respectfully requested to contact Mr. Iannucci for a telephone conference.

The Director is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

⁵ The present amendment does not discuss the optical elements of claims 32-40 in detail because such a discussion would be a distraction from the primary focus of the invention. However, the applicant continues to submit that Duboz does not teach or suggest the claimed features attributed to it by the Examiner. Thus, if the Examiner continues to reject claims 32-40 based on Duboz, the applicant respectfully requests that the Examiner identify the structures in Duboz thought to teach the features of claims 32-40.

All of the claims remaining in the application are now clearly allowable.
Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,
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Enclosure:
Wolf, Silicon Processing for the VLSI Era, vol. 2, pp.70-72

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